ID No.
SYL 2290
– RETURN TO –
INSTRUMENT CONTROL
SYLVANIA SES -- West

TYPE 1434 DECADE RESISTORS

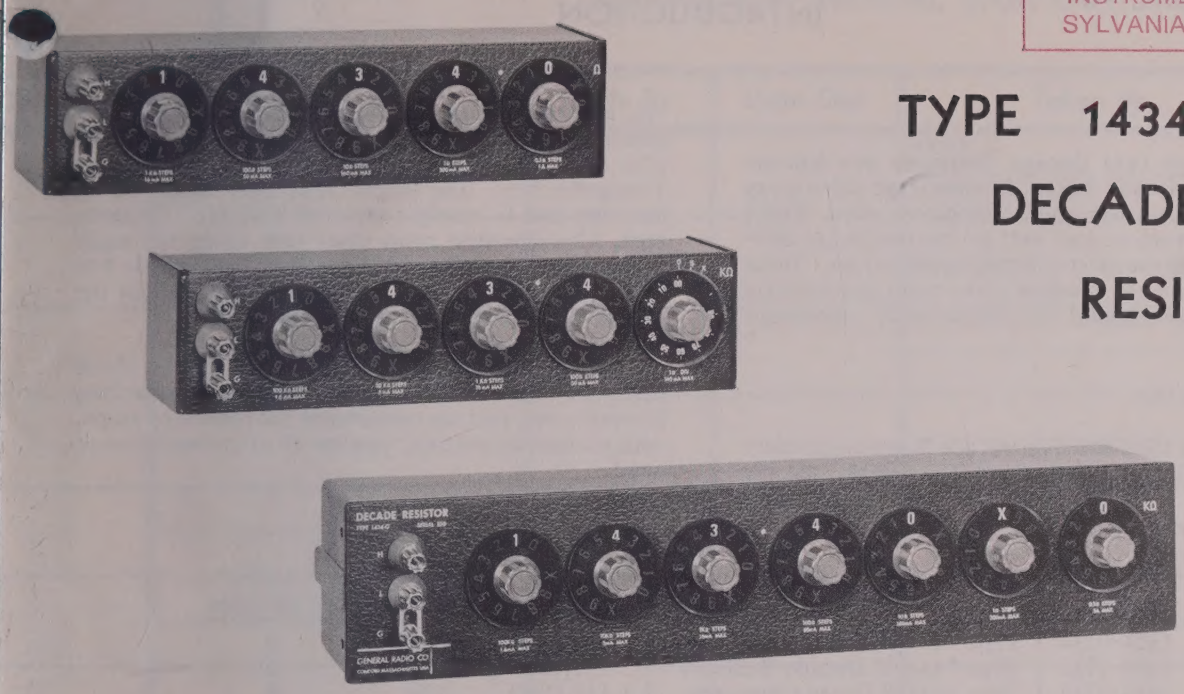

Figure 1. Type 1434-N, -QC, and -G Decade Resistor boxes.

SPECIFICATIONS

Long-Term Accuracy: Refer to Table 1. Our general two-year warranty applies to these tolerances unless the resistor is damaged by excessive current. Tolerance shown applies to both resistance increments and total resistance after correction for zero resistance.

TABLE 1

Resistance Per Decade	*Resistance Per Step*	*Accuracy**	*Maximum Current*	*Inductance Per Step*
1 Ω	0.1 Ω	±2.0%	1 A	0.01 μH
10 Ω	1.0 Ω	±0.25%	0.3 A	0.04 μH
100 Ω	10 Ω	±0.07%	160 mA	0.05 μH
1 kΩ	100 Ω	±0.05%	50 mA	0.4 μH
10 kΩ	1 kΩ	±0.05%	16 mA	4.0 μH
100 kΩ	10 kΩ	±0.05%	5 mA	
1 MΩ	100 kΩ	±0.05%	1.6 mA	
100-Ω**	1 Ω/div	±1.0 Ω	200 mA	20 μH***

* At low currents and low frequencies.
**Rheostat, used in Type 1434-QC.
*** Total inductance of rheostat.

Zero Resistance: Approximately 2 mΩ per dial at low frequencies except for the Type 1434-QC for which it is approximately 30 mΩ.

Maximum Current: Refer to Table 1. These values also appear on the panel of each decade box. When maximum current is passed through a decade, the temporary change in value of resistance will be within the accuracy specification. Appreciably higher currents will cause permanent changes.

Temperature Coefficient: Less than ±10 ppm/°C at room temperature, except for the low-valued units where the 0.4%/°C temperature coefficient of the zero resistance must be added.

Switches: Multiple, solid-silver-alloy switches are used to obtain low and stable zero resistance.

Terminals: Jack-top binding posts on standard 3/4-inch spacing. A shield terminal is also provided. The Type 1434-G has lug connections accessible from the rear.

Mounting: All types are installed in small cabinets for bench use. The Type 1434-G, with the addition of mounting hardware, becomes a 3 1/2-inch-high, 19-inch relay-rack unit.

Mechanical Data: Refer to the table below for dimensions, net weight, and shipping weight.

Models	*Width*		*Height*		*Depth*		*Net Weight*		*Shipping Weight*	
	in	*mm*	*in*	*mm*	*in*	*mm*	*lb*	*kg*	*lb*	*kg*
M,N,P,QC	11⅛	298	2¾	70	4¼	110	3	1.4	4	1.9
G (bench)	17⅜	442	3½	89	5	130	6	2.8	7	3.2
G (rack)	19	485	3½	89	3½*	89	6	2.8	7	3.2

* Behind panel.

General Radio Experimenter reference: Vol 39, No. 10, October, 1965.

SECTION 1 INTRODUCTION

1.1 PURPOSE.

The Type 1434 Decade Resistors are laboratory-quality decade boxes designed for laboratory measurement, testing, and development work. Their accuracy, incremental as well as total-value, is adequate for all but the most exacting applications. Their small size and clear readout make them particularly useful in experimental and educational laboratory setups.

1.2 DESCRIPTION.

Table 2 lists the five Decade Resistor instruments in the Type 1434 series. The Types 1434-M, -N, and -P contain five decades of resistance in a small cabinet. The Type 1434-QC has four decades plus a rheostat to provide 1-ohm resolution in a 1-megohm box. The larger Type 1434-G has seven decades and is easily converted into a 3 1/2-inch-high, 19-inch-wide relay-rack unit using the angle brackets and dress strips supplied. This decade box also has lug terminals at the rear, as well as the standard front-panel binding posts.

Six high-quality resistors are used in these decades. The resistors are combined by switching in such a way that the resistance increases by steps, with no discontinuities, just as if 10 resistors were used.

TABLE 2

Catalog Number	Description	Total Resistance	Resistance Per Step	Number of Decades
1434-9714	Type 1434-N Decade Resistor	11,111Ω	0.1Ω	5
1434-9713	Type 1434-M Decade Resistor	111,110Ω	1.0Ω	5
1434-9716	Type 1434-P Decade Resistor	1,111,100Ω	10Ω	5
1434-9576	Type 1434-QC Decade Resistor	1,111,105Ω	1.0Ω/div	4 + rheostat
1434-9707	Type 1434-G Decade Resistor	1,111,111Ω	0.1Ω	7

SECTION 2 OPERATING PROCEDURE

2.1 MOUNTING.

All Type 1434 Decade Resistor boxes are housed in small cabinets for bench use. The Type 1434-G is also supplied with additional mounting hardware for installation in a relay rack. To install the Type 1434-G in a relay rack:

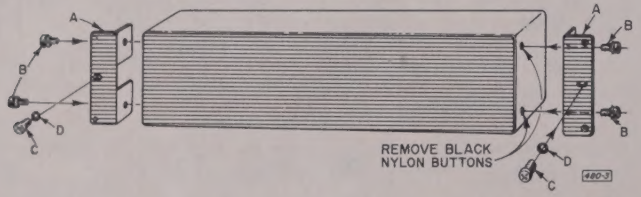

Figure 2. Relay-rack installation of Type 1434-G.

a. Remove the black nylon buttons from the holes at the side panels of the instrument. These buttons are press-fitted and are easily removed with a small screw-driver.

b. Install the 3 1/2-by-7/8-inch adaptor-panel assemblies (A, Figure 2) on each side of the instrument, using the 3/8-inch locking screws (B) supplied. The holes in the side-panel of the instrument are tapped with a 10-32 thread to receive these screws.

c. Mount the assembly in a standard 19-inch relay-rack cabinet, using the 5/8-inch No. 10-32 screws (C) and nylon washers (D) provided.

2.2 REAR CONNECTIONS, TYPE 1434-G.

This decade box has lug terminals at the rear. To make connections, remove the two 4-40 screws and the small rectangular plate from the rear panel. The lug terminals are now accessible for use and connections can be completed.

2.3 READOUT.

The rheostat in the Type 1434-QC has a selector dial with ten 10-ohm increments plus additional readout to 1-ohm per graduation. All other decades in the Type 1434 instruments have clear, easy-to-read dials with numbered steps from 0 to X (X = 10).

DECADE RESISTORS S/N 3336

SYLVANIA ELECTRONIC SYSTEMS
DIVISION OF SYLVANIA ELECTRIC PRODUCTS INC.
P.O. Box 188, Mountain View, California 94042

GENERAL RADIO MODEL 1434 I.D. NO: SYL 2290

INSTRUMENT MANUAL SIGN-OUT SHEET

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SYLVANIA SES -- West
S/N 3336

SUPPLEMENTARY INSTRUCTIONS

TYPE 1434-B, -X DECADE RESISTORS

Two additional Decade Resistors, the Types 1434-B and -X, are included in the Type 1434 series of instruments. The accompanying table lists the complete line of decade boxes available in this series.

Catalog Number	Description	Total Resistance	Resistance Per Step	Number of Decades
1434-9714	Type 1434-N Decade Resistor	11,111Ω	0.1Ω	5
1434-9713	Type 1434-M Decade Resistor	111,110Ω	1.0Ω	5
1434-9716	Type 1434-P Decade Resistor	1,111,100Ω	10Ω	5
1434-9576	Type 1434-QC Decade Resistor	1,111,105Ω	1.0Ω/div	4 + rheostat
1434-9707	Type 1434-G Decade Resistor	1,111,111Ω	0.1Ω	7
1434-9702	Type 1434-B Decade Resistor	1,111,110Ω	1.0Ω	6
1434-9724	Type 1434-X Decade Resistor	111,111Ω	0.1Ω	6

In general, the instructions for the Types 1434-N thru -G are applicable to the Types 1434-B and -X.

PARTS LIST

REFERENCE NO. Type 1434-B	Type 1434-X	DESCRIPTION	PART NO.
R101 thru R106 (for S101)	—	RESISTOR, Wire-wound, 200 kΩ ±0.035% (100 kΩ/step)	6690-4520
R101 thru R106 (for S102)	R101 thru R106 (for S101)	RESISTOR, Wire-wound, 20 kΩ ±0.035% (10 kΩ/step)	6690-4320
R101 thru R106 (for S103)	R101 thru R106 (for S102)	RESISTOR, Wire-wound, 2 kΩ ±0.035% (1 kΩ/step)	6690-4220
R101 thru R106 (for S104)	R101 thru R106 (for S103)	RESISTOR, Wire-wound, 200 Ω ±0.035% (100 Ω/step)	6690-4170
R101 thru R106 (for S105)	R101 thru R106 (for S104)	RESISTOR, Wire-wound, 19.997 Ω ±0.035% (10 Ω/step)	1434-2090
R101 thru R106 (for S106)	R101 thru R106 (for S105)	RESISTOR, Wire-wound, 2 Ω ±0.1% (1 Ω/step)	1434-2070
J101	J101	BINDING POST, Insulated	0938-3000
J102	J102	BINDING POST, Insulated	0938-3000
J103	J103	BINDING POST, Uninsulated, Ground	0938-3022
S101 thru S105	S101 thru S104	SWITCH, Rotary Wafer	7890-4240
S106	S105	SWITCH, Rotary Wafer	7890-4230
—	S106	SWITCH ASSEMBLY, R101 thru R106 0.2 Ω ±0.35% (0.1 Ω/step)	1434-2000

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS 01781

Form 1434-0100-AX
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SECTION 3 PRINCIPLES OF OPERATION

3.1 RESISTORS.

Because of its accuracy, long-term stability, low and uniform temperature coefficient, and relative immunity to ambient humidity conditions, the wire-wound resistor is the most suitable type for use at audio and radio frequencies, as well as at dc.

Resistors designed for ac use differ from those intended for use only at dc in that low series reactance and stability of resistance as frequency is varied are important design objectives.

The residual capacitance and inductance become increasingly important as the frequency is raised, acting to change the terminal resistance from its low-frequency value. For frequencies where the resistance and its associated residual reactances behave as lumped parameters, the equivalent circuit of a single resistor can be represented as shown in Figure 3. L is the equivalent inductance in series with resistance R, and C is the equivalent capacitance across the terminals of the resistor.

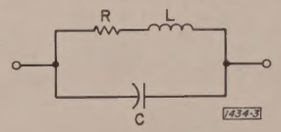


Figure 3. Equivalent circuit of a resistor.

3.2 AC CHARACTERISTICS.

The simple equivalent circuit for a single resistor (Figure 3) may also be used for a decade box although L and C will be made up of many components of inductance and capacitance. Using this equivalent circuit, the phase angle of a decade box is:

$$\theta = \frac{\omega L}{R} - \omega RC \text{ radians}$$

The phase angle will be inductive at low values of R and capacitive at high values.

The value of resistance is dependent on whether series or parallel resistance is to be considered.*

Simplified formulas for these parameters are:

$$R_{series} = \frac{R}{1 + \omega^2 R^2 C^2}$$

$$R_{parallel} = R\left(1 + \frac{\omega^2 L^2}{R^2} - \omega^2 R^2 C_D^2\right)$$

where $C = C_0 + MC_1$

$C_0 \sim 20$ to 30 pF
$C_1 \sim 15$ pF
M = Number of unused decades (set to zero) preceding largest decade used.

$$L = L_0 + N_1 \Delta L_1 + N_2 \Delta L_2 + \ldots$$

$L_0 \sim 0.1\ \mu$H per dial x number of dials in unit.
$\Delta L_1, \Delta L_2, \ldots \sim$ values shown in Table 2
$N_1, N_2, \ldots$ = readings of corresponding dials.

$C_D \sim 0.5$ pF (effective distributed capacitance)

The total capacitance from the decades to the case is about 125 pF for the Type 1434-G and 100 pF for the other instruments in the Type 1434 series.

These approximate values are valid for the two-terminal connection (case tied to lower terminal). The resistance measured with the case guarded (three-terminal connection) will be more inductive.

*For further explanation, refer to General Radio Catalog S, pp. 198, 199.

SECTION 4 SERVICE AND MAINTENANCE

4.1 WARRANTY.

We warrant that each new instrument sold by us is free from defects in material and workmanship and that, used and serviced as directed by instructions, it will perform in full accordance with applicable specifications for a period of two years after original shipment. Any instrument or component that is found within the two-year period not to meet these standards after examination by our factory, district office, or authorized repair agency personnel will be repaired or, at our option, replaced without charge, except for vacuum tubes or batteries that have given normal service.

4.2 SERVICE.

If maintenance difficulties cannot be eliminated by use of the following instructions, please write or phone our Service Department giving full information of the trouble and steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Ask for a Returned Material Tag if the instrument must be returned for service. Use of this tag will insure proper handling and identification.

4.3 TROUBLE-SHOOTING.

Wire-wound resistors in the Type 1434 instruments can be replaced by trained personnel, or the unit may be returned to General Radio for service.

To determine if a particular decade is in error, set the decade step-selector dial to step 9 and measure the value of resistance, with all other decades set to 0. Step 9 is the only setting using all six resistors in the decade (see Figure 4); an incorrect reading at this setting will indicate that one or more of these resistors is in error.

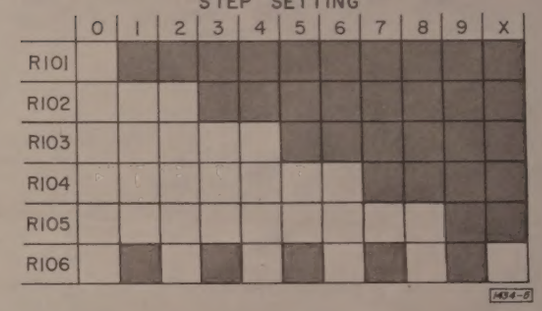
To isolate a troublesome resistor in a decade, measure the resistance at various step settings with all other decades in the instrument set at 0. (See Figure 4 for resistors used with different dial settings.) The following procedure is recommended:

a. Check R106 first by measuring the resistance at step 1 and then at step 2. An incorrect reading for step 1 and a correct reading for step 2 indicates that R106 is in error.

b. If R106 checks satisfactorily, additional measurements taken at settings 4, 6, 8, and X will indicate which of the other five resistors is giving trouble.

The physical location of resistors R101 through R106 on the decade switches is shown in Figure 5.

Figure 4. Chart showing resistors used with step settings on Type 1434 Decade Resistors.



EXPLANATION: Resistors R101 thru R105 are connected in series for even-numbered steps 2, 4, 6, 8, and X (X = 10). R106 is alternately connected in parallel with the last series resistor for odd-numbered steps 1, 3, 5, 7, and 9.

EXAMPLE: For step 5, R101 and R102 are connected in series with the parallel combination of R103 and R106.

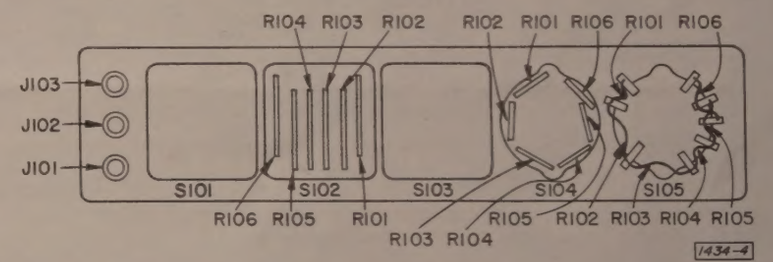


Figure 5. Rear interior view of Type 1434-N.

PARTS LIST

REF NO.	DESCRIPTION	PART NO.
	TYPE 1434-N	
R101 thru R106	RESISTOR, Wire-wound, 2 kΩ ±0.035% (for S101, 1 kΩ/step)	6690-4220
R101 thru R106	RESISTOR, Wire-wound, 200 Ω ±0.035% (for S102, 100 Ω/step)	6690-4170
R101 thru R106	RESISTOR, Wire-wound, 19.997 Ω ±0.035% (for S103, 10 Ω/step)	1434-2090
R101 thru R106	RESISTOR, Wire-wound, 2 Ω ±0.10% (for S104, 1 Ω/step)	1434-2070
J101	BINDING POST, Insulated	0938-3000
J102	BINDING POST, Insulated	0938-3000
J103	BINDING POST, Uninsulated, Ground	0938-3022
S101 thru S103	SWITCH, Rotary Wafer	7890-4240
S104	SWITCH, Rotary Wafer	7890-4230
S105	SWITCH ASSEMBLY, R101 thru R106, 0.2 Ω ±0.35% (0.1 Ω/step)	1434-2000

REF NO.	DESCRIPTION	PART NO.
	TYPE 1434-M continued	
R101 thru R106	RESISTOR, Wire-wound, 19.997 Ω ±0.035% (for S104, 10 Ω/step)	1434-2090
R101 thru R106	RESISTOR, Wire-wound, 2 Ω ±0.10% (for S105, 1 Ω/step)	1434-2070
J101	BINDING POST, Insulated	0938-3000
J102	BINDING POST, Insulated	0938-3000
J103	BINDING POST, Uninsulated, Ground	0938-3022
S101 thru S104	SWITCH, Rotary Wafer	7890-4240
S105	SWITCH, Rotary Wafer	7890-4230
	TYPE 1434-G	
R101 thru R106	RESISTOR, Wire-wound, 200 kΩ ±0.035% (for S101, 100 kΩ/step)	6690-4520
R101 thru R106	RESISTOR, Wire-wound, 20 kΩ ±0.035% (for S102, 10 kΩ/step)	6690-4320
R101 thru R106	RESISTOR, Wire-wound, 2 kΩ ±0.035% (for S103, 1 kΩ/step)	6690-4220
R101 thru R106	RESISTOR, Wire-wound, 200 Ω ±0.035% (for S104, 100 Ω/step)	6690-4170
R101 thru R106	RESISTOR, Wire-wound, 19.997 Ω ±0.035% (for S105, 10 Ω/step)	1434-2090
R101 thru R106	RESISTOR, Wire-wound, 2 Ω ±0.10% (for S106, 1 Ω/step)	1434-2070
J101	BINDING POST, Insulated	0938-3046
J102	BINDING POST, Insulated	0938-3046
J103	BINDING POST, Uninsulated, Ground	0938-3022
S101 thru S105	SWITCH, Rotary Wafer	7890-4240
S106	SWITCH, Rotary Wafer	7890-4230
S107	SWITCH ASSEMBLY, R101 thru R106, 0.2 Ω ±0.35% (0.1 Ω/step)	1434-2000

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